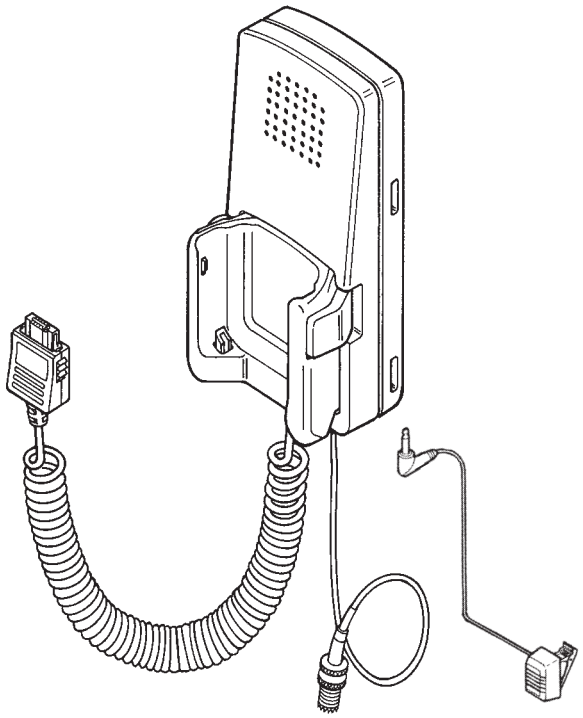
After Sales Technical Documentation

COMPACT HANDSFREE UNIT PHF–2



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COMPACT HANDSFREE UNIT PHF–2

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Introduction

The PHF–2 Compact Handsfree Unit forms a major part of the Compact Handsfree Car Kit; the kit provides a simple–to–install, low cost handsfree facility for in–car use.

The BABT approved version of PHF–2 is known as PHF–2X. Since both units are technically identical, all references to PHF–2 equally apply to PHF–2X.

Technical Summary

PHF–2 allows both handsfree (hf) and normal handset (hs) use of the phone. Handset use is possible with the curly system cable which includes an antenna cable. Detection of hf and hs operation is achieved by a reed–switch located in the PHF–2 plug which detects the presence of a magnet inside the MBH–9 holder.

The phone is connected to the unit via a system connector (fitted to the end of the curly system cable). There are also connectors for an external power source, for a standard hf–microphone and for an external antenna which must be used with this configuration.

The Compact Handsfree Unit consists of speaker and microphone amplifiers, power on/off –logic, hf–speaker muting and a constant current switching regulator for charging the phone battery. The unit has an inbuilt hf–speaker and an external hf–microphone but the actual handsfree function is generated in the phone.

The MPHF2 mechanics comprise the front and rear covers, speaker clamp, the holder cover, screws, type label, and system cable with rf–cable.

PHF–2 is installed inside the vehicle using a separate mounting plate (MKE–1). Depending upon the version of car kit being installed, the PHF–2 unit is supplied with/without the MBH–9 holder already fitted to the front of the PHF–2 unit.

List of Modules

Table 1. List of Modules

NAME OF MODULE	TYPE CODE	MATERIAL CODE	NOTES
HF Speaker Module	DH3N	0200599	
Assembly Parts PHF–2	MPHF2	0260340	
Installation Kit	PHF–1/M	0260254	

Technical Specifications

Modes of Operation

Power Off : The DH3–module does not receive a supply voltage at the DC–connector (X100), hence no voltages are present on the module.

Standby : The module receives a supply voltage at the DC–connector but the M2BUS–line (X400) is low (logic ”0” state) because the phone is off and the battery is fully charged. The switching regulator is off and there is no supply voltage for the audio.

Power On / Speaker Off : The M2BUS–line is high (logic ”1” state) so the switching regulator supplies charging current to the phone. The supply voltage for the audio is on but the PHFS–line (X400) is low (”0” state) so the HF–speaker is muted.

Power On / Speaker On : The switching regulator supplies a charging current to the phone. The supply voltage for the audio is on and the PHFS–line is high (logic ”1” state) so the HF–speaker is on.

Table 2. List of Connectors

CONNECTOR NAME	CODE	NOTES		POLES
DC–Supply Connector	X100	Power Supply Input	Vdc	2–pole
HF–Microphone Connector	X200	Microphone Input	HFMIC	2–pole
HF–Speaker Connector	X300	Speaker Output	HFSP	2–pole
System Connector	X400	Phone Cable Connector	HHP	8–pole

Maximum Ratings

PIN/ CONNECTOR	LINE SYMBOL	MAXIMUM	UNIT/NOTES
X100/1	VB	32	Vdc (without damage)
X100/1	VB	1.3	Adc

PIN/ CONNECTOR	LINE SYMBOL	MAXIMUM	UNIT/NOTES
X300/1	HFSP	3.5	Vrms
X300/1	HFSP	3.0	W

PIN/ CONNECTOR	LINE SYMBOL	MAXIMUM	UNIT/NOTES
X400/1	VC	13	Vdc
X400/1	VC	870	mAdc
X400/1	VC	150	mVp–p ripple 100...500kHz

DC Characteristics

Table 3. Supply Voltage and Power Consumption

PIN/ CONNECTOR	LINE SYMBOL	MINIMUM	TYPICAL/ NOMINAL	MAXIMUM	UNIT/NOTES
X100/1	VB	10.8	13.2	15.6	Vdc
X100/1	VB	500	600	1200	mAdc

Table 4. Charging Current Output

PIN/ CONNECTOR	LINE SYMBOL	MINIMUM	TYPICAL/ NOMINAL	MAXIMUM	UNIT/NOTES
X400/1	VC	11	12.2	13	Vdc
X400/1	VC	730	800	870	mAdc

Control Signals

Table 5. Control Signals (DC–values)

PIN/ CONNECTOR	LINE SYMBOL	MINIMUM	TYPICAL/ NOMINAL	MAXIMUM	UNIT/NOTES
X400/2	M2BUS	0		5	Vdc
X400/3	PHFS	3.6 0		5.2 0.7	Vdc (speaker on) Vdc (speaker off)
X400/4	GND (logic)		0		Vdc
X400/5	AGND (audio)		0		Vdc
X400/6	XEAR/HFJPWR	1	2.5	4	Vdc
X400/7	XMIC/JCONN	0		10	Audio–Vdc
X400/8	AGND (audio)		0		Vdc

AC Characteristics

Table 6. Audio Levels

LINE SYMBOL	TYPICAL/NOMINAL	UNIT/NOTES
XMIC Cable level	200	mV rms
XEAR Cable level	130	mV rms

Table 7. Audio Gains

LINE SYMBOL	TYPICAL/NOMINAL	UNIT/NOTES
HF–microphone amplifier gain	40	dB
HF–speaker amplifier gain	27	dB

Table 8. Audio Specifications

ITEM	MINIMUM	TYPICAL/ NOMINAL	MAXIMUM	UNIT/NOTES
HF–Speaker: SPL	78	80	82	dB/1W/1m
Speaker output power			3.0	W
XEAR input impedance	10			kohm at 1kHz
XMIC output impedance			2.0	kohm at 1kHz

External Signals and Connections

Table 9. DC Supply Connector, Uin 13.2VDC

PIN	LINE SYMBOL	PARAMETER	MIN	TYPICAL/ NOMINAL	MAX	UNIT/NOTES	
1	VB	Input Current		0.8	1	mA	Power Off
1	VB	Input Current	50	70	90	mA	Power On, No Charging
1	VB	Input Current		0.6	0.8	A	Power On, Charging On
2	GND	Logic Ground					

Table 10. DC HF–microphone Connector

PIN	LINE/ SYMBOL	PARAMETER	MIN	TYPICAL/ NOMINAL	MAX	UNIT/NOTES
2	HFMIC	Output Voltage		5.0	5.8	V
2	HFMIC	Internal Resistance		2200		ohms
2	HFMIC	Input impedance		1000		ohms
1	GND					

Table 11. DC HF–speaker Connector

PIN	LINE/ SYMBOL	PARAMETER	MIN	TYPICAL/ NOMINAL	MAX	UNIT/NOTES
1	HFSP	Load Impedance		4		ohms
1	HFSP	Output Power			3	W
2	GND					

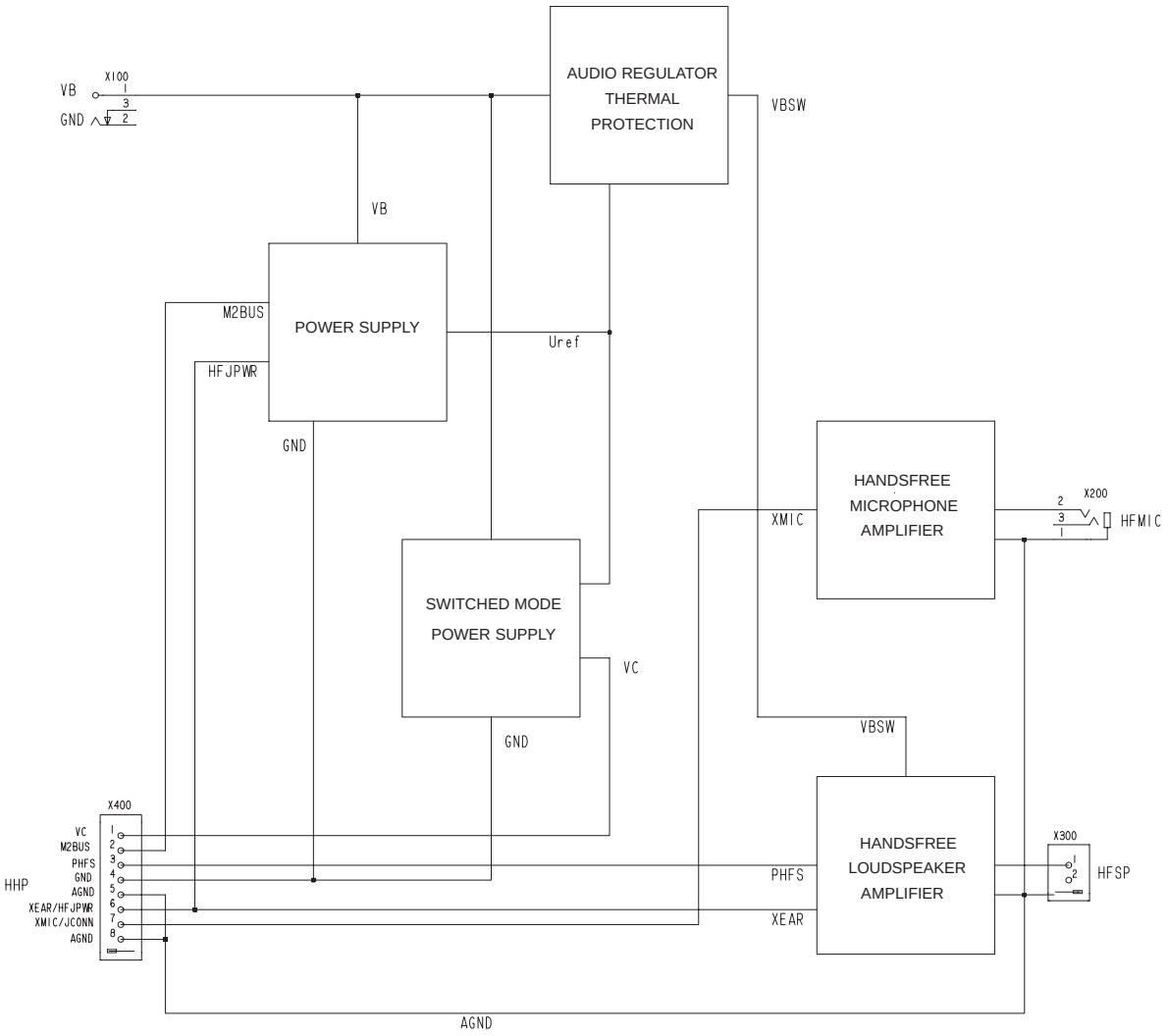
Mechanical Characteristics

Table 12. Mechanical Characteristics

UNIT	DIMENSIONS (mm) (W x H x D)	WEIGHT (g)	CABLE LENGTH (m)	ENCLOSURE (MATERIAL ETC.), COLOUR
PHF–2	68 x 160 x 34.5	320	0.18 (coiled) 1.8 (uncoiled)	Material: G Cycloy, C1000 HF Colour: Warm Black

Functional Description

Figure 1: Block Diagram



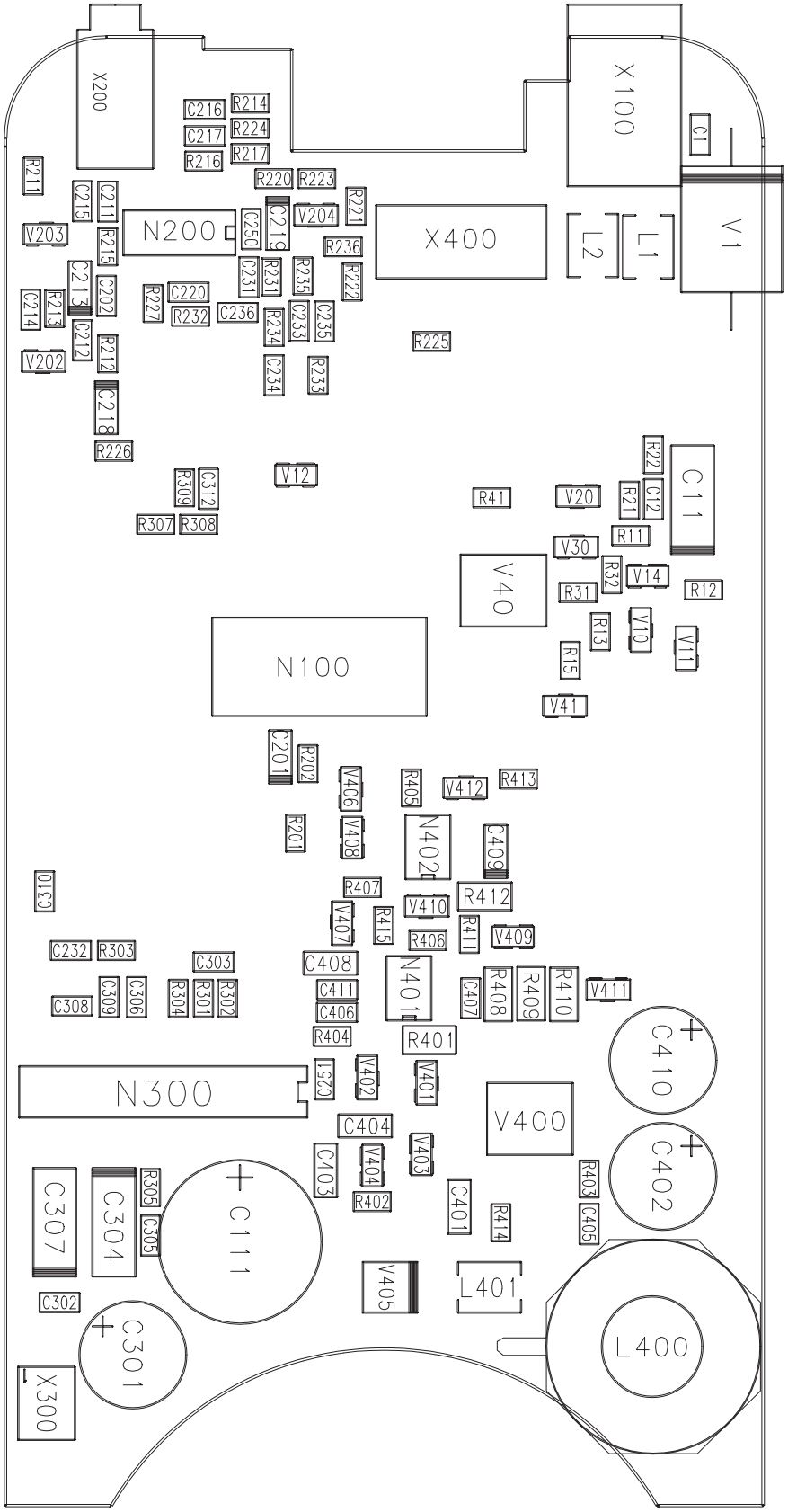
Circuit Description

Input Circuit

The input circuit contains the following components:

- C1 – EMI capacitor
- F1 – foil fuse
- L1 / L2 – EMI suppressor chokes
- V1 – voltage suppressor diode (zener type)

Figure 2: Component Layout Diagram



Power Control Logic

Power is applied to the audio devices via P–FET V410 and 10V regulator N100 (VBSW) when the M2BUS signal goes high. The XEAR signal can also switch the power on for 5 seconds as the XEAR signal goes low. The same 5 second power–on also occurs when power is applied and the MBUS and XEAR signals are low. C11 acts as a timing capacitor to generate this second period.

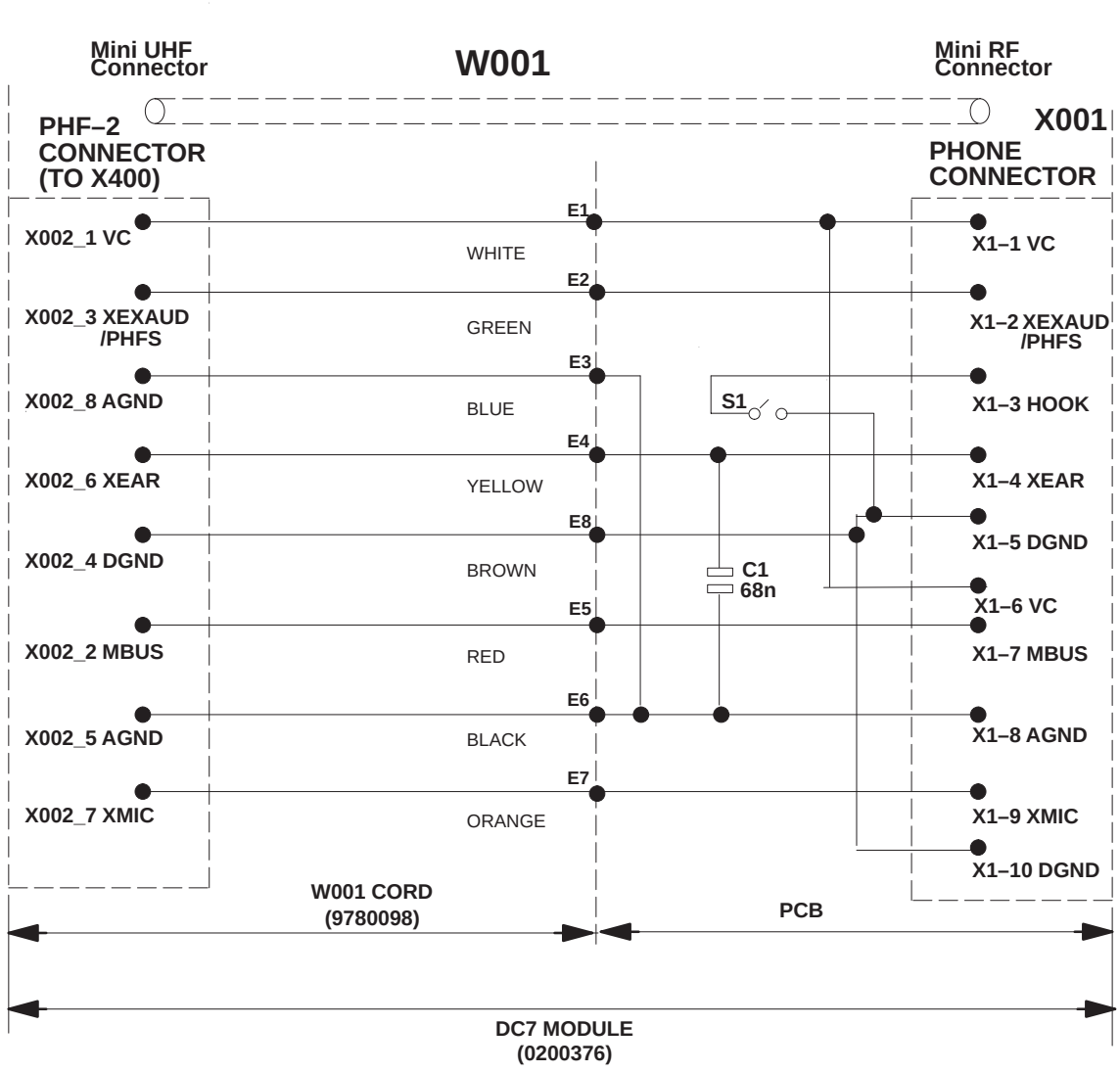
Switched Mode Power Supply

The VBSW voltage generated by N100 powers reference regulator N402 which starts the switched mode power supply (SMPS). V409 provides the initial current to a totally empty battery. V410 is a constant current source which sets the voltage level of R408 – the same voltage occurs across the current shunt resistor R410 when the SMPS is operating. N401a acts like a pulse width modulator; N401b in conjunction with R407, C408 and V408 generates a minimum pulse width for the SMPS. R405 and R406 disable the pulse width modulator (N401a), turning off the SMPS when the VB input voltage is greater than 17V. V407 limits the comparator power supply VCC; V408 and V406 limit the output voltage of the comparator. V403 and C403 form a 'bootstrap' circuit which acts like a voltage doubler to supply power to the V400 power switch. L401 (L402), R403 and C405 are EMI suppression components. L400 forms the main SMPS inductor; V411 limits the maximum output voltage.

Audio Circuit

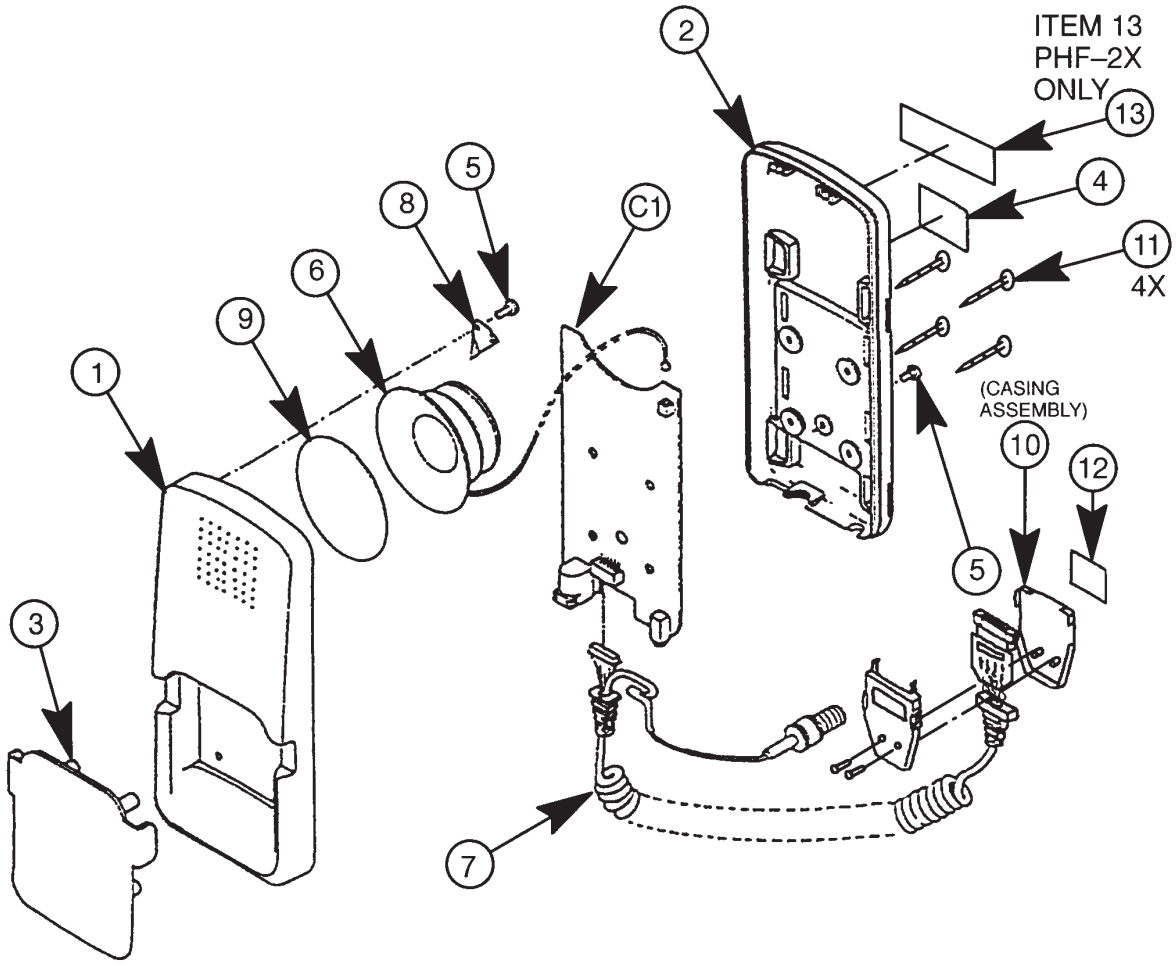
The N200c, R201 and R202 combination generates a +5VA audio dc voltage. V202 is the microphone voltage regulator; N200b is the microphone amplifier; N200a is a differential amplifier which eliminates disturbances generated in the curly cable ground wire. N200d has the same function in the XEAR–line. R235 and C231 form a low pass filter designed to eliminate high frequency noise. N300 is the power amplifier which supplies the signal to drive the loudspeaker. Components R301, R302 and C303 serve to stabilize the operation of the power amplifier at high frequencies.

Figure 3: Cable Interconnection Diagram



Assembly

Figure 4: Exploded View



Assembly Parts

ITEM	QTY	CODE	DESCRIPTION	VALUE
1	1	9450368	Front Cover	D6472
2	1	9450255	Cover B	1D22197
3	1	9450369	Cover C	D6473
4	1	9380154	Type Label	4D22419
5	2	6293012	Pt–Screw KB22X8	WN1442
6	1	5140098	Loudspeaker	4C23574
7	1	0200376	DC7 Connector Module	
8	1	9510211	Holder	4D24728
9	1	9309555	Loudspeaker Cloth	A4D40368
10	1	5469800	Accessory Plug Casing	MQ138–NKK
11	4	6292240	Pt–Screw KB25X14	WN1441
12	1	9380378	Silver Label (Blank)	4D24
13	1	9380488	BABT Label (PHF–2X only)	A12455

Parts List

ITEM	CODE	DESCRIPTION	VALUE	TYPE
R011	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R012	1412536	Chip resistor	22 k	5 % 0.063 W 0805
R013	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R015	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R021	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R022	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R031	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R032	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R041	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R201	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R202	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R211	1412261	Chip resistor	100	5 % 0.063 W 0805
R212	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R213	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R214	1414029	Chip resistor	3.3 k	5 % 0.063 W 0805
R215	1414131	Chip resistor	180 k	5 % 0.063 W 0805
R216	1414212	Chip resistor	330 k	5 % 0.063 W 0805
R217	1414283	Chip resistor	100 k	1 % 0.063 W 0805
R220	1414283	Chip resistor	100 k	1 % 0.063 W 0805
R221	1412430	Chip resistor	10 k	5 % 0.063 W 0805

R222	1412335	Chip resistor	1.0 k	5 % 0.063 W 0805
R223	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R224	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R225	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R226	1414283	Chip resistor	100 k	1 % 0.063 W 0805
R227	1414283	Chip resistor	100 k	1 % 0.063 W 0805
R231	1414283	Chip resistor	100 k	1 % 0.063 W 0805
R232	1414283	Chip resistor	100 k	1 % 0.063 W 0805
R233	1414283	Chip resistor	100 k	1 % 0.063 W 0805
R234	1414283	Chip resistor	100 k	1 % 0.063 W 0805
R235	1414109	Chip resistor	15 k	5 % 0.063 W 0805
R236	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R301	1413829	Chip resistor	10	5 % 0.063 W 0805
R302	1413829	Chip resistor	10	5 % 0.063 W 0805
R303	1412261	Chip resistor	100	5 % 0.063 W 0805
R304	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
R305	1412261	Chip resistor	100	5 % 0.063 W 0805
R308	1414109	Chip resistor	15 k	5 % 0.063 W 0805
R309	1412430	Chip resistor	10 k	5 % 0.063 W 0805
R401	1415784	Melf resistor	4.75 k	1 % 0.2 W 0204
R402	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R403	1411669	Chip resistor	22	5 % 0.063 W 0805
R404	1412423	Chip resistor	4.7 k	5 % 0.063 W 0805
R405	1414420	Chip resistor	680 k	5 % 0.063 W 0805
R407	1413635	Chip resistor	100 k	5 % 0.063 W 0805
R408	1415600	Melf resistor	1.0 k	1 % 0.2 W 0204
R409	1415600	Melf resistor	1.0 k	1 % 0.2 W 0204
R410	1411123	Melf resistor	0.22	5 % 0.2 W 0204
R411	1412423	Chip resistor	4.7 k	5 % 0.063 W 0805
R412	1421108	Melf resistor	30.1 k	1 % 0.2 W 0204
R413	1412423	Chip resistor	4.7 k	5 % 0.063 W 0805
R414	1411669	Chip resistor	22	5 % 0.063 W 0805
R415	1412416	Chip resistor	2.2 k	5 % 0.063 W 0805
C001	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C011	2604431	Tantalum cap.	10 u	20 % 16 V 6.0x3.2x2.8
C012	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C111	2503072	Electrol. cap.	470 u	20 % 16 V 10x16
C201	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.8
C202	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C210	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C211	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C212	2310336	Ceramic cap.	18 p	5 % 50 V 0805

C213	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.8
C214	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C215	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.8
C216	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.8
C217	2310449	Ceramic cap.	150 p	5 % 50 V 0805
C218	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.8
C219	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.8
C220	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C231	2310720	Ceramic cap.	3.3 n	20 % 50 V 0805
C232	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C233	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C235	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C236	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C250	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C251	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C301	2502736	Electrol. cap.	220 u	20 % 16 V 3.5mm
C302	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C303	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C304	2604431	Tantalum cap.	10 u	20 % 16 V 6.0x3.2x2.8
C305	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C306	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C307	2604431	Tantalum cap.	10 u	20 % 16 V 6.0x3.2x2.8
C308	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C309	2310784	Ceramic cap.	100 n	10 % 25 V 0805
C310	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C312	2310336	Ceramic cap.	18 p	5 % 50 V 0805
C401	2309517	Ceramic cap.	100 n	10 % 50 V 1206
C402	2501605	Electrol. cap.	100 u	20 % 35 V RM3.5
C403	2309517	Ceramic cap.	100 n	10 % 50 V 1206
C404	2309517	Ceramic cap.	100 n	10 % 50 V 1206
C405	2310544	Ceramic cap.	1.0 n	5 % 50 V 0805
C406	2310752	Ceramic cap.	10 n	20 % 50 V 0805
C408	2310752	Ceramic cap.	10 n	20 % 50 V 0805
C409	2604209	Tantalum cap.	1.0 u	20 % 16 V 3.2x1.6x1.8
C410	2502736	Electrol. cap.	220 u	20 % 16 V 3.5MM
C411	2310449	Ceramic cap.	150 p	5 % 50 V 0805
L001	0164030	Choke	9 u	
L002	0164030	Choke	9 u	
L400	3607555	Coil	2 A	
L401	0164030	Choke	9 u	
V001	4103496	Trans. supr.	33V	400 V 5000 W d9.1xl9.1
V010	4210108	Transistor BSR20	pnp 12 V 0.6 A SOT23	

V011	4107040	Zener diode	BZX84	5 % 6.2 V 0.3 W SOT23
V012	4108639	Diode x 2 BAS28	75 V 250 mA SOT143	
V014	4108639	Diode x 2 BAS28	75 V 250 mA SOT143	
V020	4210106	Transistor BSR19	npn 14 V 0.6 A SOT23	
V030	4210106	Transistor BSR19	npn 14 V 0.6 A SOT23	
V040	4200610	MosFet IRFR9010	p–ch 50 V 5.3 A TO252	
V041	4107026	Zener diode, BZX84	5 % 7.5 V 0.3 W SOT23	
V202	4210106	Transistor BSR19	npn 14 V 0.6 A SOT23	
V203	4100285	Diode x 2 BAV99	70 V 200 mA SER.SOT23	
V400	4215954	MosFet RFD14N05	n–ch 50 V 10 A TO252	
V401	4210106	Transistor BSR19	npn 14 V 0.6 A SOT23	
V402	4210108	Transistor BSR20	pnp 12 V 0.6 A SOT23	
V403	4108639	Diode x 2 BAS28	75 V 250 mA SOT143	
V404	4108639	Diode x 2 BAS28	75 V 250 mA SOT143	
V405	4110074	Schottky diode	STPS340U	40 V 3 A SOD6
V406	4107160	Zener diode	BZX84	5 % 12 V 0.3 W SOT23
V407	4107027	Zener diode	BZX84	5 % 16 V 0.3 W SOT23
V408	4108639	Diode x 2 BAS28	75 V 250 mA SOT143	
V409	4108639	Diode x 2 BAS28	75 V 250 mA SOT143	
V410	4200917	Transistor BC848B/BCW32	npn 30 V 100 mA SOT23	
V411	4107160	Zener diode	BZX84	5 % 12 V 0.3 W SOT23
V412	4107027	Zener diode	BZX84	5 % 16 V 0.3 W SOT23
N100	4340108	IC, regulator	L4810	10 V 0.4 A SOT194
N200	4301182	IC, 2 x op.amp.	LM2902	SO14S
N300	4303440	IC, af amp+mute +4/30v dil1	TDA1905, DIL16S	
N401	4305236	IC, 2 x comp.	LM2903	SO8S
N402	4301062	IC, regulator	LP2951AC	SO8S
X100	5414943	Dc–jack d6.3/2 pcb		
X200	5407016	Jack stereo 2.5mm smd		
X300	5416640	Pin header m1x2 p1.5 90deg 1a0r02, A0R02		
X400	5416638	Connector 8–pole right angle 1.5		
	9460035	Coil		
	9853924	PC board DH3	116.9x61.0x1.6 d 3/pa	